PAVEMENT RECYCLING with ASPHALT EMULSIONS

Distressed Pavement

The following are descriptions of the various methods of pavement recycling with asphalt emulsions available. For additional and more detailed information, please refer to the AEMA Recommended Performance Guidelines.

RECYCLING with ASPHALT EMULSION

Recycling is the reuse, after processing, of a material which has served its first intended purpose. After completing the asphalt recycling process and curing period, a surface course is placed. This may be an asphalt emulsion surface treatment, or a cold or hot mix overlay. Asphalt emulsions are used in pavement recycling with the following processes:

(1) Hot and Warm Central Plant.
(2) Hot In-Place Recycling.
(3) Cold In-Place & Central Plant.
(4) Full Depth Reclamation.

Candidates for recycling are usually old pavements that have severe cracking, potholes, or other distress. Many pavements have untreated bases which are strengthened when treated with asphalt emulsions. Asphalt in old pavements may be brittle from aging. Asphalt emulsion or emulsified recycling agents can improve the properties of the existing asphalt binder.

Other advantages of recycling include:

(1) Allows use of existing materials; eliminates disposal problems.
(2) Gradation and asphalt content can be improved.
(3) Pavement profile may be corrected; improved curb reveal.
(4) Cost reduction over conventional methods.

Drum Plant

Batch Plant

HOT & WARM CENTRAL PLANT

This method usually involves the removal of substantial pavement structure. In some cases this process may involve removing untreated base material underlying the asphalt surface. Removal of these materials is generally done with a rotary drum milling machine, though a ripping/crushing operation may be used.

The reclaimed asphalt pavement (RAP) is hauled to and processed at a central plant site, either with a drum or batch plant. The RAP may require screening and pulverizing to remove oversize material. The RAP materials are blended warm or hot with asphalt emulsion or emulsified recycling agent. Virgin aggregate may be added to improve gradation, or to increase the mat thickness to improve load carrying capacity.

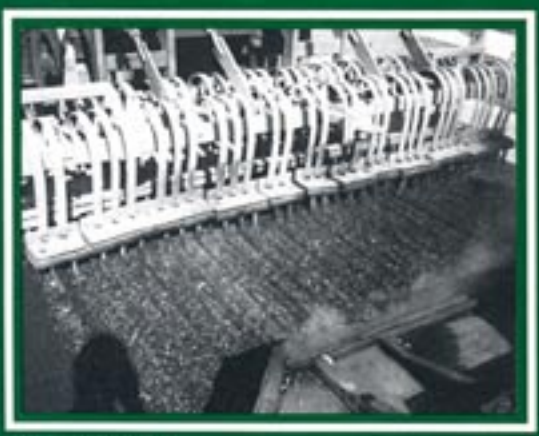
The recycled mix is returned to the paving site and placed like hot mixed asphalt.

ADVANTAGES: High mix production, accurate control of materials, and faster recycled mix strength development.

LIMITATIONS: Traffic control, trucking equipment availability.

Remix

Repave



Heat/scarify

HOT IN-PLACE

Special equipment is used to heat and soften existing pavement to allow for scarification or rotary mixing to a specified depth. Heated and scarified pavement is mixed with an asphalt emulsion or emulsified recycling agent.

The single pass method offers two different variations: the REMIX process and the REPAVE process. In the REMIX process, RAP, emulsion, and virgin hot mix are combined and thoroughly mixed; the combined material is then placed. In the REPAVE process, the RAP is blended with emulsion, mixed and placed; while still warm, a new hot mix asphalt course is immediately placed over the recycled mix in one pass.

In the multiple pass method, the pavement is heated, scarified, and mixed with emulsified recycling agent and relaid. The surface or wearing course may be placed immediately or within the following few days.

ADVANTAGES: Aggregate gradation and asphalt content may be improved by some variations of this process. Asphalt binder properties, such as flexibility and adhesion, are restored or improved with specially formulated recycling agents. Ruts and holes are filled, shoves and bumps are leveled, drainage and crown are re-established.

LIMITATIONS: Depth of treatment.

Pugmill

COLD CENTRAL PLANT

Many of the procedures used in hot recycling are employed in central plant cold recycling. The techniques for obtaining and handling the RAP materials and placing the finished mix are identical. The difference is that mixing of RAP and asphalt emulsion or emulsified recycling agent is accomplished by a portable pugmill without heat.

Virgin aggregates may be added to improve gradation or to increase mat thickness for load carrying capacity.

Cold recycled mixes may be stockpiled through proper emulsion formulation.

ADVANTAGES: Very good control of materials and mixing. Useful for large projects. May be used when the surface must be removed to allow work on the underlying base materials. Equipment is easily moved.

LIMITATIONS: Equipment availability.

Recycling Train

COLD IN-PLACE SINGLE-UNIT

In this method, precise control of depth of cut is provided by a rotary drum milling machine. The cut can be controlled to utilize only asphalt pavement, or in some instances, recover some of the underlying untreated materials.

Within this method are various steps which are similar though the equipment configuration may differ, e.g., some operations discharge directly into the paver hopper while others place the recycled mix into a windrow for pickup into the hopper. Both methods use a self-propelled asphalt paver with automatic controls.

Single Unit Process

The asphalt surface is removed to the predetermined depth. The RAP and asphalt emulsion are combined and mixed within the cutting chamber. Sizing of the RAP and the amount of asphalt emulsion may be synchronized with the forward speed of the machine at a predetermined depth of cut. The recycled mix is either placed into a windrow or directly into the paving machine hopper.

ADVANTAGES: Good control of gradation and mixing. Cracks are interrupted. Controlled depth of treatment.

LIMITATIONS: Base problems may not be addressed within the cut depth.

Recycling Train

COLD IN-PLACE TRAIN

This method involves several pieces of equipment, attached as a train, which recycles the pavement surface. A milling machine acts as the towing unit and delivers precise depth of cut. This unit provides preliminary sizing of the RAP. The RAP is then transported over a screening unit which catches any oversize material and diverts it to a crushing machine for final sizing.

After all materials have been properly sized, the RAP is transferred to a pugmill for mixing with asphalt emulsion, and finally placed into a windrow or placed directly into the paving machine hopper. The quantity of emulsion is controlled by a computer which monitors RAP production from a belt scale. An alternate method is a pump synchronized with the forward speed of the train.

ADVANTAGES: Best control of gradation, mixing, and proportioning of all in-place methods. High production rates.

LIMITATIONS: Works well, but only within depth of cut. Equipment availability.

Blade Mixing

Hammermill

FULL DEPTH RECLAMATION

With this process, the full depth of asphalt pavement and a predetermined amount of underlying untreated base are recycled. Virgin aggregates may be spread on the surface and incorporated into the mix to improve gradation.

Full depth reclamation consists of three basic steps: pulverizing, introducing and mixing an asphalt emulsion and any virgin aggregates, and grading and compacting. This is followed by a surface course of asphalt emulsion cold mix or surface treatment.

There is a variety of equipment available for this process. The finished product will be similar with all of the equipment, with speed of production being the largest variable.

Pulverization of the in-place materials may be accomplished by ripping and crushing, hammermills, or self-propelled reclaiming machines. All must be capable of reducing the pavement to specified size.

Asphalt emulsion may be spread by a distributor and mixed by a motor grader, or injected in the processing machine. Final shaping may be done with the motor grader.

As an alternative, a self propelled travel plant may pick up a windrow, proportion and mix the asphalt emulsion, and place the recycled mix to grade. Many times the mat is spread and ready for compaction.

Reclaiming Machine

Travel Plant

FULL DEPTH RECLAMATION

continued

ADVANTAGES: Inexpensive method of rehabilitation. The equipment is mobile. Offers the opportunity to improve structure and correct geometry. Controlled proportioning and gradation when specialized equipment is used. Process may use surface treatment as wearing course. May be used in conjunction with other methods of recycling.

LIMITATIONS: Deep reclamation may require more cure time and additional compaction after initial processing.

NOTES

Pavement Recycling with Asphalt Emulsions is intended as a guide to briefly explain the methods available. It is not intended as a selection guide since there are other factors to consider in determining the most appropriate application. For further information, please consult the Recommended Performance Guidelines published by the AEMA or contact your local AEMA member company.

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